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Questa è la Versione finale referata (Post print/Accepted manuscript) della seguente pubblicazione:

Original Citation:

TAXING BANKING FIRMS: A CONCEPTUAL FRAMEWORK / R. De Bonis; D. Monacelli; M.G. Pazienza. - In: RIVISTA DI STUDI SULLO STATO. - ISSN 2038-4882. - ELETTRONICO. - (2011), pp. 1-31.

Availability:

This version is available at: 2158/776731 since:

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(Article begins on next page)

04 May 2023

Rivista di Studi sullo Sta

Saggi e Articoli

05 ottobre 2011

TAXING BANKING FIRMS A CONCEPTUAL FRAMEWORK

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Taxing Banking Firms: A Conceptual Fram[1]

Public finance theory has relegated the analysis of taxatio
exclusively -financial firms. The explanation is, to a
disciplines have often regarded taxation and its effects mai
forces driving or hindering growth potential and wealth. The
the development of modern economies has become one of sch
research. Although financial intermediation has been recogn
supporting the performance of economic activity, its role has
to include in the picture. Some peculiarities of the impact of
on financial firms activity can be traced in the literature,
analysis has not arisen yet.

The objective of this paper is to present a description of
analysis of the effects of taxation on financial firms (FFs) activit
on banking. More specifically, the aim is to assess wheth
intermediaries may result in effects on their decisions that si
expected in the standard-financial firms (NFFs). After consi
differences already envisaged by the economic theory an
arrangements, the analysis focuses on those peculiar featur
business structurally different from the others and that may
identical tax regime to produce a distinct incidence process wh

The paper is organised as follows: paragraph 1 reviews the
the literature on taxation to find possible integrations; par
peculiarity of FFs, and of banks in particular; in paragraph 3
to identify the aspects that are relevant to the way taxation
paragraph 4 considers the issue of cost of capital in the c
paragraph 5 reconsiders the traditional effective tax rates a
adopt it to the special case of banks; finally, in paragraph 6 conclusi
mainly suggesting strategies for integrating the different a
literature and taxation literature, analysed in the paper.

1. Banking vs. Taxation Literatur

Literature on banking regards financial intermediation as a production
process under several respects. The relevance of this issue is
banking firms play, acting as financial intermediaries among
ensuring the link between saving and investment, and directing c
towards the most efficient uses. By providing, not only hous

[1] Le opinioni presentate sono personali e non coinvolgono la responsabilità dell'Istituto.
L'articolo è stato redatto nell'ambito di un progetto di ricerca condotto nel

firms with financial services that are instrumental to their bus
decisions.

The debate about the role of banks has taken place[2] for a long
been very rich and has pointed to the uniqueness of banks
aspects and related to the[3] last decades, the development of new
intermediaries, with their consequent challenge for the supervisory regulation
economists attention to issues like financial systems and fin
the question of the role of banking. Meanwhile, banking theor
simultaneous progress in information, game, and finance theories. This p
a body of literature on banking that, focussing on the microeco
implications of banking firms behaviour for macro aspects like
instability risk of banking systems, banking regulation, moneta
channels. In doing so it allowed to overcome the unsatisfacto
approach that had been looking at these aspects separately
existence of the banking firms without explicit justification.[4] The microeconomics of
banking firms highlights the peculiarities of their productio
context in which they perform their activity. The recognition
testified also by the analysis of the institutional arrangemen
developed countries, since they all prescribe specific regula
firms. Banking literature looks at these - broadly - constraints as a tax on
intermediaries, defining it as quasi taxation .

The recognition of the peculiarity of banking activity does
acquired by taxation[5] literature.

Generally speaking the characteristics of any producti
peculiarities), inevitably shape the structure of firms balance s
for their ability to adjust to, and possibly shift, the burden im
this phenomenon is always present when comparing firms reacting
operating in different economic sectors, it certainly plays a
banking firms. For instance, the high degree of substitutab
instruments implies bigger and more immediate opportunities
the supply side, by the savers, and from the demand side, by i
effect of the same change in the tax rate applying to all firms a
could than be more widespread and rapid in the first case.

---

[2] For one of the first attempts to elaborate a general theory of the bank s
(1898, 1934).

[3] The specific role of banking firms has been attributed by the economic
credit functions they perform, by providing the economy with liquidity, sup
these two functions through maturity transformation (alternatively stressing
aspects). An extensive analysis of this literature is not the object of thi
example, to the very useful reviews in Santomero (1984, 1997) and Bhatt
subject are Fama (1985), Goodhart (1986, 1987), Diamond and Dybvig (19
Hellwig (1985).

[4] See, for example, Marotta and Pittaluga (1993).

[5] The issue has received more attention only recently. In 2003 the Wor
project on Taxation of financial intermediation (edited by Honohan), whic
contribution on the subject. With respect to our analysis, the focus is mor
on financial intermediaries. See also Huizinga (2004).

Banca d'Italia

Under a theoretical viewpoint, the attention of scholars i
captured by issues related to the taxation of the FFs activity
itself (mainly direct taxation).

Within the framework of tax alternative nature has focused on the c
aspects involved in the optimality of exempting financial instr
services may be considered intermediate inputs for NNFs. Po
different models used usually depend on the assumed role of mon
regarded as consumption or intermediate good. Theory did not
about the opportunity to treat FFs and NFFs homogenously,
services of both. From the institutional viewpoint, however, most of
made the choice of exempting financial services from VAT. Th
on the difficulties arising from the VAT tax base definition
banking intermediation services (deposit collection and lending).
services from VAT implies that banking firms, contrary to those
representing the final consumer for the (intermediate) goods t
pay for the corresponding VAT and are subject to VAT on inves

Regarding direct taxation,[6] with only little exceptions specific concern arise
taxing financial firms per se. The main issue traces back to the tax
optimality of taxation of capital income in all its forms, in orc
taxation of consumption.[7] However, this is obviously a much more gener
taxation of firms without distinctions among financial activities. Several
arguments may be opposed to the view that supports imposing capital specifi
far as corporate tax is concerned: corporate tax has to resp
criteria, but also to equity ones (by taxing corporations[8] de
taxations on their income; corporations are recognised an abil
shareholders ; corporations benefit from public expenditure c
have to contribute by some benefit principle; and so on). These other
goals are apparently relevant enough to prevail in the institut
tax systems.

There seems to be broad consensus among taxation schola
applying corporate tax to the same principles, both to FFs and N[9]
special rules are typically devised by the tax systems to take
activity, they are perceived simply as minor adjustments tha
neutrality.[10] These corrections to the general criteria usually concer

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[6] For example, Caminal (2004).

[7] See, on the topic, Boadway and Keen (2003) and Caminal (2003).

[8] Corporate tax is often justified on the grounds that it allows to tax profi
tax systems it usually taxes also the component of profit remunerating own

[9] As far as we could conclude from a review of taxation literature, ther
explicitly recognising the need to consider both the similarities and the
treatment provided by the existing tax systems, arguments for the rational be
normative choice. In principle, the income of financial institutions should be mea
of other business. Although financial institutions are subject to the usua
receives special treatment (Stiglitz, 1985).

[10] It is revealing, for instance, that Honohan (1999) and Keen (1998) address the
associated with financial regulation, tax incentives and tax distortions. An important practical issue in this regard is the treatment of loan loss re
authorities have tended to err on the side of refusing to accept loan loss

loan loss reserves and credit loss devaluation. However, act
sometimes in a position of confronting problems arising exac
impact expected on FFs by specific forms of business taxation.
either tax rates diversification or specific prescriptions in
enlightening example is the IRAP case in Italy.[11]

To understand how the peculiarity of FFs firms may affect the mecha
taxation works out, it is necessary to examine the meaning of the main
underlying the decisions of production, investment and fina
relevant questions such, input, output, accumulation, value added, finan
so on, can be defined for a FFs and in what these concepts di
concepts as applied to a non-FFs firm.[12] Such a conceptual framework a
map out where how taxation can distort the choices in the FFs decisi
focus on the differences with respect to the NFFs.

Form such an exercise, a revision of the economic meaning
commonly used in tax policy analysis arises as well. Indeed,
questionable whether the ordinary tools to assess the distorti
firms decisions, developed from NFF models, may be appropr
and in particular to banks. This problem is severe in case of in
explicitly based on some underlying model of the firm's behavi
marginal or average effective tax rates).

In some cases the issues turn out to be more of an empirica
the quantitative relevance of a channel of transmission of th
example the impact of taxation on the financing decisions,
theoretical implications.

2. What is different in banks' decis

Firm's decisions concern real aspects, like investment and financial
aspects, like financing.

The current state of the art fundamentally draws from the
theory by Modigliani and Miller (M&M)[13] and M&M's theorems that
corporate investment and finance. The firm's objective is modelled
maximisation of the market value of the corporate equity, rep
wealth. In a frictionless world, with complete market information, and
taxes the value of a firm is independent of its financial structu[14]
increase in financial leverage would increase financial risk a
accordingly, restoring the equilibrium. In such context, the cost of capital is g

---

income, fearing that they will be used to excess as an unverifiable way of
that banks are usually too slow to recognise the risk of loan losses and to provi
this regard we could be restoring the tax incentive to make adequate advance
1997) (p. 4; our underlining)

[11] This issue is analysed in details in Farabullini, Maurizi, Monacelli and P

[12] See on this matter the paper by Gobbi and Zotteri (2005), which is part

[13] Modigliani and Miller (1958, 1963), Miller (1977), (1988), just to remembe

[14] This is known as Proposition I

capitalisation rate of a pure equity stream from the same cla
development of the Capital Asset Pricing Model (CAPM) in fi
treatment of the role of risk in decisions descended, which co
incorporated in the cost of capital from M&M framework, by
capitalisation rate.[15] The basic M&M model was progressively enr
directions, to ensure more realism. The first step was the in
corporate and personal taxes and bankruptcy costs, which allo
optimal financial structure for the firm, by generating revenue
finance. Other developments focused on the removal of some of the res
of the original M&M version.

Public finance interested into this approach by elaborating
capital concept to disentangle the tax component, i.e. Fabozzi such
branch of tax literature originated, from Jorgenson's contribu
(1963) to King and Fullerton[16] development of the marginal effe
conceptual framework proved extremely powerful for tax analysis
enough to allow a very detailed modelling of all the most rele
tax systems and offered significant advantages in terms of int
comparisons.

The use of such tools, however, may be some when applied
Once their activity is examined more in detail, indeed, it is
theoretical models are hardly capable of satisfactorily desc
operate. The efficient market hypothesis, in the subsequent derivat
original M&M model, is particularly troublesome. Strictly spea
intermediary institutions would be redundant in a world where,
model, all the economic agents access to the same information at t
under these hypotheses, finance should not matter because th
surplus could directly finance those who are in deficit without

The features of banking which set them in contrast with the mode
M&M theory are well captured by another stream of literature
meanwhile within the industrial organisation (IO) approach.[17] According to this approach
the existence itself of financial intermediaries is justified by market imper

In the following paragraphs we discuss what, in our opinio
the more relevant aspects emerging from IO literature on ban
from using M&M derived models in case of banking firms. They can be s
follows:

1. the peculiarities of the production process (the joint nature of output; th
   relevance of inputs, the intrinsic role of financial risk, the
   asset/liability composition and production);
2. the anomalous role of deposit liquidity in financing decisions

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[15] Hamada (1969), Rubinstein (1973).

[16] The discussion of these indicators is presented in chapter 5.

[17] See Freixas and Rochet (1997). Financial market imperfections are synthetically, in fo
economic agents have to bear costs (transaction, monitoring, etc.) that sp
more efficiently face due to informational advantages by intermediating in
these services. To do so they simultaneously buy and sell financial instruments

3. the present banking supervision

2.1 Production process

Most of the peculiarity in banking production process depe
output. According to modern banking theory, banks are financial firms that
(production approach). This approach differs from a somewh
that stresses the intermediation process[18] among deposits and loans. A
consequence is that deposits are seen as output, contrary to th
that treats them as inputs for the provision of loans.[19] From our point of view, we find it
to follow the production approach.

The supply of financial services is embedded in specific financial instruments such as loans and
deposits, but also other financial products (the supply of
increased, as the composition of interest margins vs. fees and
of the in-bundled services is usually assumed equivalent to the pro
financial instruments themselves. We claim that, although the
seem captious and redundant, it actually helps in better identi
revenue and most ite

Bank s production-process output is characterised by a hig
jointness.[20] As a good example of these characteristics is given by the
deposits and loans.

The fact that the financial services provision is embedded in financial items
generates a much stricter link between production decisions
Indeed, most of output provision directly reflects into changes
bank s balance sheet.[21] For instance, loans supply increases assets, while deposi
increases the liabilities. This feature is not straightforward t
terms traditionally used when considering NFFs. For instance,
of bonds for its own account, which are assets, can be put on a par with the
usual NNFs analytical framework, the increase in the asse
investment is, indeed, by following this very same logic that in

---

[18] Sealey and Lindley (1977).

[19] In banking literature, deposits are sometimes treated as input to loans,
sometimes both on empirical results (Hancock, 1985). As Freixas and Rochet (1997)
concern in identifying inputs and outputs is how to classify demand depos
deposits are used in the production of the financial service, it is an input. The problem with su
that demand deposit services, which are final services, are then not count
part of the payment (p. 83).

[20] Onado (1996), in describing the operational aspects that distinguis
of banks from other industries, underlines the characteristic of banking activity
that the peculiarity of the bank is supply of a multiple products is characteris
jointness and productive intertwining much more intense (p. 37; with translation).
sustain his argument he gives the example of the supply of deposits, which
input for the supply of loans.

[21] This phenomenon characterizes, in particular, the money supply, where the
issue claims on themselves accepted as money by the public, namely
own debt. As far as the supply of other services leaving the stock variables
it must be reminded that their share has increased over time with the diver
Gobbi and Zotteri, 2005

Company Taxation introduced Financial Assets item among the investment destination of firms capital. Although such a trea case of NNFs, it certainly raises problems in case of FFs, and is questionable, at least, in our opinion, whether it is legitimate to co investment rather than as pure production, giving rise to reven

In other words, production of a bank may be seen as asset that the position of the bank's balance sheet reflect output financing decisions as it would be for a NFF: any increase in decision to supply deposit rather than a decision to resort to investment. If an increase in liabilities in case of a banking f production that generates revenue, not to higher investment. This issue has obviously relevant implications for the definition of the gives major difference between FFs and NFFs, which make it very economic framework in the analysis of the firms decisions.

As for the input side, we assume a production process where ban inputs as other firms (capital, labour, intermediate goods or the typical one characterising the FFs: among capital inputs marginal role; on the other hand, investment in non-financial assets capital (development of software, etc.) may be extremely rel labour intensive. A specific aspect to consider is a higher sha training, which seems to signal more significant investment term the effects induced by the tax treatment of corporate income, intensity are high labour taxation and property taxes, and lowe capital.[22] Summarising, from the input side the difference between banks and particularly NFFs, is relatively intensity of the factor composition.

Sketching the production process in a very simplified way, bank produces a bunch of items, mainly delivered in some mix of fi products like loans, deposits and other products, linked by a relationship

[1] $Y = g(L, D, OP)$

by using a production function with physical capital, labour, and intermediate goods inputs

[2] $Y = f(K, L, X)$

subject to a very simplified asset/liability constraint equalis items, deposits equity on the liability side, and loans, securities the asset side:

[3] $D + E = L + B$

When output changes to the supply of new loans or deposits t the outstanding stock, or due to the provision of other that affect for instance stocks on bank's balance composition of the balance modified consistently. Even in a static context, this link wo

---

22 Consequently, the weight of the tax incentives to physical capital accumulation tends to be lower as well.

23 For a more formalised analysis see Monacelli and Pazienza (2005).

24 A more realistic constraint would include at least liabilities issued eq acquired on the asset side.

relationship, which is actually complicated by the presence of equity capital. To say it differently, the output choice for a bank is more like a financial investment choice of the asset/liability composition.

Finally, an element of differentiation of the production process of NFFs stems from the role played by risk. Risk characterises any production activity, but in the case of FFs it has stronger implications. Indeed, financial instruments, represent a way to manage risk. As a result, financial intermediation is risk management by definition. The relevant implication for our purposes is that, in the evaluation of profits and of the company value, risk may not be neglected.

2.2 Finance decisions

The complex relationship between output and composition choices further points to a more substantial criticism against the mere extension of approaches developed within the M&M paradigm to the banking firm.

Whether financial liabilities represent a source of finance for the firm, or simply output (or both) is crucial for the identification of a consistent framework for assessing the consistency with the Europe-wide tax regime of the most relevant share of banks' liabilities. In a production perspective, deposits contribute the supply of financial services exactly as loans do, and should be considered output. Revenue from deposits arises from banks supplying a lower interest rate to depositors, with respect to the rate they would pay if raising funds in the inter-bank market for their own financing purposes. The difference between the two rates is the price charged for the service it offers the clients in terms of liquidity and immediate disposal of the money cash deposited.

This peculiar aspect of banking activity has implications for the capital structure determination. For NFFs, in a M&M framework, debt would increase the risk of financial distress costs raising the financial risk of the firm, and the cost of capital. In case of a bank the links become more complex. An increase in debt raising output may also increase the value of the firm. Therefore the cost of capital reflects the higher financial risk associated to the higher leverage and the value of the services supplied by means of the new deposits. Under these circumstances, the conditions ensuring separability between investment and financial choices do not work.

If for a bank debt generates revenue from the supply of financial services, and not only costs, it seems reasonable to assume that banks have an incentive to extend their leverage beyond what NFFs would do. In particular, since their ability to earn revenues on debt issuance, banks may not internalize the costs from increasing debt, so that in principle they may find it profitable to finance without limit (or at least within much lower limits than NFFs[25]

[25] According to Diamond and Rajan (2000), if certainty, the bank's amount of credit it can offer by financing deposits with a given capital structure

banking systems benefit from monopoly power in collecting
recognised by laws and regulations and it is usually associa
synthetically d eis nc thbe next paragraph.

The peculiar nature of debt and the related regulatory re
conclusion that banks determine their optimal financial stru
decision process from the one characterisking, NtFhe Fs. fSi rnmc tlly
structure represents more the counterpart of output decision
ones. Therefore, risk capital should be regarded as the major
banks employ debt as much as they can and use risk capital to
between two exogenous constraints: the regulatory requi
requirement bank(uptcy costs and reputation, bank s governanc
information between bank [26] and investors). The result is a optimal financia
structure mainly reflect external constraints, rather than the
choice carried out by NFFs.

2.3 Banking regulation

Banks and, to a lesser extent, other financial institutions
subject to regulations that do not apply to NFFs. The rationale
banks' specificity, as expressed by the collection of liq
contemporaneous granting of illiquid loans. This peculiarity
associated to legal restrictions, because only banks can issue li
on demand. This feature has been considered at the origin of
historically contributed to the creation of Central Banks [27], and
to the introduction of supervisory regulations, such as the b
many European countries in the 19th century. These different forms of
regulations are justified by the need to ensure the soundness and
correct functioning of the payment system, the normal fina
economy.

Even if more extreme positions in favor of free banking mus
is generally agreed that a sound and safe banking system must
combination of capital requirements and other supervisory a
market discipline, on the other side. Countries differ in the
supervision and market discipline to ensure this balance [28].

---

[26] See, on this topic, Berger, Herring and Szego (1995).

[27] See, for instance, Goodhart (1985) and Dybvig, for a examination of different strands
literature such as: the classical bank run models (Diamond and
banking crises and currency crises, whose analysis has been reinforced b
Asian economies in the second half of the Nineties; the new analysis of the
De Bandt and Hartmann, 2000).

[28] Many critiques have been raised towards bank regulation. The theory of
civil servants and legislators are not only motivated by the pursuing of the
private goals. Stigler was the first to claim that government agencies may act not in
but may be captured by the interests of the subject who are regulated.
banking periods shows that the quantitative importance of bank regulation
(Kaufman, 1996). These views are summarized by the idea that banking arra
the market would have produced a more satisfactory outcome than was a
involved (Friedman and Schwartz, 1986).

the main forms of supervision in Europe and other countrie
supervision have been seen as having implications[29] as they may introdu
distortions in banking business. Similarly to the financial repression
literature which emphasized that credit ceilings, controls of inte
requirement ratios and other regulatory measures have been
levels of financial intermediation together with credit ceilings and
of interest rates, because these measures have been aboli
attenuated in poorer ones.[30]

The reserve requirement was certainly in the past a tax on banks
were required to hold a percentage of their deposits, in terms o
central banks accounts, which were remunerated at lower
Originally introduced as a prudential supervision instrument,
evolved as a control tool of the multiplicative mechanism of deposit
same time the reserve ratios decreased in many countries wh
banks funds in the accounts with the Central banks increased.

In the euro area the reserve ratio is 2 percent of the outstanding s
reserve is remunerated at a market rate. In the Eurosystem th
reserve system are the stabilization of money market interest
the structural liquidity of the banking system. Reserve ratio
outside the euro area countries and are now less onerous than
is still concern for high reserve ratios in some countries,[31] main

Capital ratios are probably the most frequent measure of prude
the world. This was mainly due to the 1988 Basle accord that introduced the i
international banks had to maintain a ratio equal to 8 percent cer
assets. Capital is split into two types: Tier1 and Tier2. Tier1
funds for general banking risks, and innovative instruments
Tier2 includes revaluation reserves, hybrid instruments, su
provisions, unrealized gains on equity. Tier1 must be at leas
capital.

Formally,

$$[4] \quad Tier1+Tier2 = 0.08 \sum_{i=1}^{n} RWA_i \qquad s.t \quad Tier1 \geq 0.5(Tier1+Tier2)$$

where A_i represents the assets and RW_i the associated risk weight the accord
banking regulation.

The capital ratio was introduced to ensure a "level pl
international credit institutions active in the same markets. S
was introduced in many countries and often extended to
institutions. The capital ratio is often conceived as a buffer st
to cover credit losses, even if it is arguable that a capital r
sufficient if a hard bank crisis takes place. Whether or not this justificatio

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[29] See, for instance, Huizinga (2004).

[30] For administrative measures in UK and Italy see Goodhart (1991) and P
(1996) on financial repression in Mediterranean countries.

[31] See, for example, Cannata (2004).

capital ratio, i.e. the idea that it is an incentive compatible r
banks' shareholders.[32] Shareholders may limit their risk propensity if
provide a minimum amount of capital. Many countries in the world intro
requirements based on the 1988 Basel Accord, which was
endorsed in June 2004.

Banks often have a capital ratio higher than 8 per cent.
derives from the action of market forces and
supervisors that 8 per cent is only the minimum level of capita

Here we remember the four key principles for the supervisc
second pillar of the Basel 2 agreement:

a) Banks should have a process for assessing their overall capita
their risk profile and a strategy for maintaining their capital
b) Supervisors should review and evaluate banks' internal cap
and strategies, as well as their ability to monitor and ensure thei
regulatory capital ratios;
c) Supervisors should expect banks to operate above the min
ratios and should have the ability to require banks to hold
minimum;
d) Supervisors should seek to intervene at an early stage to p
below the minimum levels required to support the risk chara
bank, and they should require remedial action if capital is not maintained.

Finally, even if they often influence the composition of ba
we will not deal with the forms of banks supervision used diff
may refer to measures as barriers to entry, activity restrictions, concentration
banking business, separation between banking and commerce,
supervisory action variables.[33]

3. What implication for the appraisal influence?

The analysis carried out in the previous chapter
in this paper is of some relevance. Banks' business is pecul
activity under many respects. The next step is to investigate
aspects that distinguish banking firms from business may, indee
consequences in terms of the ways taxation influences them and
of the instruments generally used in taxation literature to asse
useful.

Among the issues that have been considered by literature on the effects[34]
most relevant are represented by the influence of taxation on (1)
employment; (2) capital investment; (3) financial structure; (4) international
allocation of capital (and the tax competition); (5) corporate governance.

[32] See Santos (2001) for a review of the literature.
[33] See Barth, Caprio and Levine (2001) for a survey.
[34] See Mintz (1995), for example.

All of these issues may be touched by the peculiarities of t
process. The analysis carried out so far, for example, showed
from other firms one for at least the first three issues in the ab

As far as labour employment decisions are concerned, the higher labour int
leads to a more significant weight of taxes on labour. These a
employer s and at the employee s level and may take different f
systems of the specific countries. Payroll taxes, social secu
income taxes may have different forward and backward shifting
last decades European countries have experienced a relative h
taxation with respect to capital income taxation. This is due
integration, enhancing the role of taxation especially on the
factors like capital. The combination of fiscal rules to ensu
finances, from one side, and greater impact of tax differential
countries to a progressive decrease of the tax rate which first p
labour income being less subject to tax competition. Less capi
intensive firms, like FFs, may have been penalised by this p
consider, which could play in the opposite direction is the higher role of hum
within FFs production process. Actual tax systems impose virtu
capital component, so that they implicitly allow for immediate
costs.[35] Sometimes avoidance constraints to these deductions are pre
laws, reducing the potential advantage. A similar conclusion r
of intermediate goods.

Investment decisions are also an important source of difference be
NFFs or FF banking firms the role of direct taxation on physic
(depreciation allowances, tax incentives, and corporate tax r
This is the case for machinery and inventories, due to the lim
financial intermediation. It is less so, for the investment in
inputs. As a result, differences in the treatment provided by ta
may contribute generating a very different tax burden between NFFs and FFs. Another
important element of diversification when considering the over
acquisitions is the need to include for banking firms also the
investment due to the financial services exempt from VAT (present both
final stage of the VAT chain). The same issue concerns interm

The issues addressed above point to differences in the
differences in the relative weight of otherwise common determ
particular in the production factors intensity. This more easi
assessment of the tax effects for a banking firm with the use o
on the traditional approach in taxation literature. A step in a
this direction.

On the other hand, the mechanisms through which financial taxation
of a banking firm may be more difficult to reconcile with the t
by taxation theory. Such an attempt could help

[35] The drawback of this treatment is that input cannot benefit from p
advantages from investment incentives. These issues are more extensively
Pazienza (2005).

of an optimal financial structure, due to the peculiar nature related regulatory requirements. In our opinion a promising wa is by looking for in the meantime a more realistic model of the finan bank, which is able to capture the output aspect of these cl models available from traditional taxation literature. The ma ensure consistency among the underlying assumptions of the two app

The next paragraph focuses mainly on this last issue by ex cost of capital for a bank and by making a first attempt to in different framework. As we will see, the proposed solution is more s the representation of the bank's decision process is concerned detail allowed in modelling taxation, especially when compared to th

4. Cost of capital

Cost of capital can be defined as the expected return that capital su the firm's uncertain future cash flows, for which the cost of on the financial structure, for banks mainly consisting of debt. The emphasis on equity capital as the variable traced in banking lit mainly in connection with the internal capital allocation decis comparisons of cost[36] of capital.

As a very rough simplification, we can classify cost of framework of finance theory, into two broad categories: the fir as a relevant proxy for expected returns; the second one with focus respect to the average[37] market return.

a) according to Dividend Valuation Model cost of capital is the discoun makes the share price equal to the stream of discounted futu[38]

$$[5] \qquad P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+c)^t} \quad .$$

Assuming, for the sake of simplicity, that dividends grow at a c obtain the classical Gordon growth model for price and the yield increased by dividend's rate of growth:

$$[6] \qquad c_0 = \frac{D_0 (1+g)}{P_0} + g$$

---

[36] Differences in the cost of capital across countries may arise from pe Temporary differences can be due to disequilibrium in capital markets and differences in sh fundamental values; more permanent differences can be ascribed, among others, to differe policies, taxes, capitalizations of banks, and macroeconomic policies mix.

[37] For a more detailed classification, see Sironi (1996).

[38] The main problems with this theory concern the evaluation of the future price of shares for banks not quoted on Stock Exchange. Moreover, financ for a constant stream of dividends, irrespective of the value of the firm on t increase in cost of capital that depends only on speculative movement in st

Slightly different is the case of the earnings-price ratio. Under the assumption that a
are good proxies for future return expected by shareholder
distributed as dividend, cost of capital is

[7] $c\delta = D_n / P$.

b) According to Risk Value Model, the risk premium in excess of R_f the ris
can be used as a proxy for the rate of return that shareh
assumption that actual risk will remain unchanged in the future (
approach), cost of capital can be calculated as $R_f + \beta$. In this framework, the Capital
Asset Pricing Model (CAPM) considers cost of capital as the sum of
and the systemic risk premium (which is a characteristic of the CAP
identification of the coefficient β measuring the volatility of the return
share, relative to the volatility of the market (or market, that is
capital is $R_f + \beta (R_m - R_f)$ where R_f is the return on a risk free investment
market return.[40]

In the case of banking firms, the valuation of cost of capita
regulation that implicitly influences the valuation measures dis
that, within Dividend Valuation, explicitly takes account of capital regulat
with the different impact implied for the cost of capital by th
output, can be traced in Zimmer and McCauley's model.[41]

The authors refer the cost of capital of a bank to the equity o
required spread or fee that a financial product must generate
bank. Because banks are compelled by Basle Accord rules to h
capital is largely determined by the amount of equity in the market value of th
and, to a lesser extent, by the risk premium.[42] Made in order to assist
referring to the product, time of sale, or to specify that the cost of ca
(after expenses) spread required to generate the required return
constitutes only a share of the total spread.[43] Following the dividend valuation
models, McC&Z define the equity return as net profit divided b[44]

Besides stressing that high leverage is not a result of an
broadly affected by regulations, McCauley and Zimmer (McC&
role of debt in evaluating cost of capital also to the bank competitio

---

[39] More in detail, β is the ratio of the covariances between the market return and the
variance of the market return.

[40] It is worthwhile to stress that the CAPM relies on several strong assump
troublesome for a bank model: asset markets are perfect, frictions are less
simultaneously available to all agents; there are no imperfections such as
risk free asset that investor can borrow or lend in unlimited amount and a
model considers debt as a pure financial instruments while, as previous
component of the bank's production function.

[41] See McCauley and Zimmer (1989, 1990, 1991). For a discussion of the promising features o
assessing the role of taxation see Di Majo (1999).

[42] McCauley and Zimmer (1990) p. 536.

[43] McCauley and Zimmer (1990) p. 538.

[44] Clearly, profit rate must be depurated by temporary factors
must reflect the long run earnings potentials of the financial firm.

deposit rates.[45] Moreover, in case of the funded products (i.e. out
need funds to be produced), interest rates on debt instrumen
affect the interest rates on loans, but according to the author
substantially irrelevant in terms of the interest margins. Si
determining the cost of capital is the spread, the level of int
directly influence the required return from investment projects
unfunded products (i.e. financial products dissociated from
which the cost of debt financing is clearly irrelevant.

The cost of capital in McC&Z framework is therefore diff
usually considered by the in traditional taxation literature.

In the traditional approach the cost of capital (usually referred
tangibles) and is given by the sum of economic depreciation plus f
cost of purchasing capital input). By comparing marginal revenue
capital input, the decision whether to take investment under the assumption
equilibrium firms equalise marginal cost and revenue of the inv

On the other hand, in McC&Z the cost of capital refers only to t
and is given by the remuneration that the bank shareholders expect
the profitability of the bank's activity (net of all the operating costs
the convenience for the bank's shareholders to. Input to their own purchase,
the price of the financial products supplied by the bank, for
loan, must generate a return wide enough to cover the costs of the inputs
(labour, capital and material costs), plus the risk premium on
loans) and taxes.[46] If the bank sets the spread or the fees below its c
a loss for its shareholders. More precisely, while return on equity
value of the bank's shares.[47] The exact expected return will be dete
the market conditions: it will be exogenous to the bank in perf
can reflect the imposition of a mark-up over the marginal cost, depending on the
imperfection of the market.[48]

To simplify extremely, while the concept of cost of capital
refers to the outstanding amount of equity given by the remuneration that shar
for it, in the traditional framework, able to better describe NFF
cost of acquiring physical capital and for the issuing of new equity
or resorting to debt. The firm, for the bank the main asset that is debt

---

[45] The cost of capital as defined does not include the cost of debt financi
debt for tier 2 capital), despite the fact that banks are highly levered. T
competing in the same market pay much the same interest rates at the ma
does not bear directly on the required return on equity (Modigliani and Miller (1958), p. 53

[46] According to some empirical literature, shareholders of international firms
Demirgüç-Kunt and Huizinga (1999). The burden of corporate income tax appears to be p
customers & bank stock investors, as the tax rate is independent of the level of comp
31. For a more recent study, see Albertazzi and Gambacorta (2005).

[47] In order to raise or keep constant the value of the bank, the profit rate
as the profit rate on existing equity. See McCauley and Zimmer (1990), p. 538.

[48] For instance Moshirian (2001), who adopts this definition of cost of cap
in banking, observes that the spread is set in such a way that it is at
may use the spread as a proxy for the cost of capital for banks. Thus, the
cover their cost of capital, the less competitive is their position in the inte

return from the overall production, while for the NFF it is sim
savers ask in order to direct their financial resources to the fi

The presence of banking regulation complicates the matters. require banks to hold different quantity (and quality) of capi linked with output choices, that is, the cost of financial inputs depends on the output Therefore, in computing the cost of capital (and the effective tax rate) we s not so much distinguish among different types of investmen financial sources, as it is usually done, but rather among diffe

For each product, the cost of capital is the rate of return that allows t regulatory capital to earn the rate of return demanded by the investors[49] and determined in order to maintain at least the same value of shares. More specifically, for 8 per cent of Tier1 capital (ordinary) and Tier2 (supplementary capital) c activities, prescribing that contribution of Tier1 capital must overall ratio. A higher cost is associated to Tier1 capital finan to Tier2 capital, i.e. other shares and various forms of subo would be favoured as a financial source. Therefore, if the c margin any increase in output would imply an equal increase in Tier2 capital. The cost of capital associated to a specific financia increase of asset i in the balance sheet must satisfy:

$$A_i R_i (1-\vartheta t) = RW_i A_i \, 0.08 CT_1 + RW_i A_i \, 0.04 CT_2$$

where

A_i = asset
R_i = return spread of net (asset of production costs)
ϑt = corporation tax rate
RW_i = risk weight of asset i (ranging from 0 to 150%)
CT_1 = cost of Tier1 (shareholders equity) c
CT_2 = cost of Tier2 (other equity and subordinated debt) capital.

Normalising and reorganising terms:

[8] $R_i (1-\vartheta t) = RW_i \, 0.08 (CT_1 + CT_2)$

From which an expression for the cost of capital:

[9] $cc = R_i = R[W_i \, 0.08 (CT_1 + CT_2)] / (1-\vartheta t)$

The approach by McC&Z may provide several specification in connection with the funding requisite of the instrument tha taxation impact is concerned, the specific marginal source of T

If a product is funded (as a loan) by a simultaneous incre is given by two components: the return on the asset that is su required capital, which depends on the type of capital and the increase imposed by the capital ratios. Different values of the spread r

[49] See McC&Z (1991).

capital may be obtained: if for example a new loan is supplie
funding by deposits corresponds, the overall return will be given by the sprea
the entire loan plus the return from investing the required 8 p
risk free asset. If, on the other hand, only the 92 per cent of
and the residual part by the reserves from the required capita
return will depend on the marginal source of Tier2 capital ch
represented by shares (like preferred shares), than the return
between the interest borrowing and lending, only on 92 per cen
difference between the interest rate on loans and that on a ris
8 per cent. If the 4 per cent of the required Tier2 capital is
debt, the interest spread component will apply to 96 per cent
differential with respect of the free asset rate only for 4 per c
hand, the product is not funded, it will simply give rise to th
fee and from the alternative use of the collected capital. The
will also depend on the products that are supplied, since they
risk weights for the capital ratios purposes.

These returns will have to be considered net of tax, which m
chosen financial instruments. Indeed, the Tier1 capital compo
deductions,[50] while in case of Tier2 capital some components, like
debt,

Some expressions for the cost of capital in [8] are summ
different hypotheses are assumed, according to the compos
marginal source of Tier2 capital. Taxation enters the returns expres
from the assets and by introducing a tax saving from the deduc

Table 1 Cost of capital under capital ratio constraints

S = interest spread on funded products, net of fee; F = fee on unfunded products, net
production costs; r = interest rate on free asset; C_{T1} = cost of Tier1 capital; C_{T2} = cost of Tier2 capital.
C_{PS} = cost of Tier2 capital when provided by preferred shares; C_{SD} = cost of Tier2 capital when supplied by subordinated debt.
RW_i = risk weight associated to asset i; t = corporate tax rate.

[50] However, part of Tier1 capital is represented by reserves, for which the
from the equity component. This issue is not considered here.

This model implies a very simple treatment of taxation an
Corporate taxation reduces the return from the assets and hen
the cost of capital. This increase is partly compensated by the tax savings from the a
deductions in case of a corresponding increase in the Tier
subordinated debt. The size of this compensatory effect dep
associated to the acquired asset.

To contrast the increase in the cost of capital determined by the ta
may have different opportunity of tax shifting, according to
conditions. Their shifting behaviour therefore could affect
decisions. In the following, however, a full tax shifting behavi

Although this approach has the advantage of highlighting i
link going from corporate taxation to bank's cost of capital, a
financial products, it is not satisfactory enough as far as the
and tax shifting is concerned. Indeed, the aspects taken into c
ones by which taxes would actually influence the expansions o
the other relevant aspects, for instance, there are depreciatio
deductions for tax purposes, that would reduce the cost of cap
before, may have a very different influence on the banking firms' co
integrate the analysis of the cost of capital in the direction o
taxation, some hints may come from literature on the marginal

5. Tax indicators: Do we need to be c
different for banks?

The tools traditionally proposed by public finance literatu
impact and the distortionary role of taxation are tax rates o
extensive literature on the identification of the best tax indic
suitable ones obviously depending on the economic questio
measure might provide the answer. Without going into details[51]
the main lines of research on the issue of tax measurement.

The three main families of tax rates are the statutory tax rate, the tax rate backward-
looking effective and forward looking effective. The first ones are widel
comparing corporate taxation systems, but do not give information
burden, which is obviously influenced by the definition of the
of indicators looks at the ratio between taxes actually paid
aggregate for the tax base (e.g. profits, operating surplus, etc.)
the factors determining the tax burden, both the statutory an
instance, the economic cycle). The third one is the most p
theoretical incidence from the application of tax laws (especially
rates and other ways in which taxable income is defined) to
specific capital investment project; it is given by the ratio b
difference between gross and net present value of tax return from the

[51] For extensive discussions on this issue see OECD (2001), Chennells and Griffith (2000), May (2000) and
Devereux (2004). For an analysis of the problem related to financial firms s

investment. This approach usually refers to a marginal inves
extra-profits, and gives rise to the so-called marginal effective tax rates[52]. It
therefore measures the share of cash flows necessary to pay taxes, at the m
firm were to invest in a specific capital input, typically i
inventories, or industrial buildings.

When dealing with banks, all these families of indicators[53] r
However, it is clear that the forward looking approach asks
modification. Traditional METRs, indeed, focus on the investme
assets, and hence do not seem particularly adequate when cas
tangibles represent only a low share of total assets and are
production function.

Even less satisfactory, from our perspective, is the eq
investment decision of the FF and the acquisition of financial
Financial assets acquisition, in a framework like ours, is to be
input accumulation. The cost would be a cost of overall produ
capital. Moreover, the capital expenditure should be distinguished according
output, in order to take into consideration the effects of capital
risk capital necessary to finance 1 unit of investment varies a
output that is generated.

Since the role of capital investment, at least in the tradit
significant for a financial firm, while it can be more convenient, as a
more accurate to consider a method that EATR, or generates tax differe
inputs and to switch from an investment decision to a production
perspective. On this line of research the synthetic measure pr
and Scharf (1997) can be employed to obtain how taxes impos
upon the cost of doing business[54].

5.1 A model without taxation

Starting from the basic representation of the production fu
previously introduced by equations [1] and [2], the bank's c
capital, labour and intermediate goods, can be represented as

[9] $C(\cdot) = p_c K(\cdot) + wL + p_x X$

Drawing from McKenzie, Mintz and Scharf's methodology
application to banks[55], focus on the loan production function, in a w
In this framework[56], the cost function to be minimized can be simplifie

---

[52] The METR were originally proposed by King and Fullerton (1984). Dev
developed this approach with reference to marginal investments, called the effective
average marginal tax rates (EAMTR). The average derives from the fact t
as the average of taxes due on investments with different profitability levels.

[53] See Monacelli (2004).

[54] McKenzie, Mintz and Scharf (1997), p. 339.

[55] McKenzie (2000) proposes a model of perfect competition that may not
sector but has many similarities with tax analysis.

[10] $C(L_n; Z_L, Z_X, Z_K)$

where Z are the user costs.[57] The input marginal intermediation cost functions can be derived on the basis of the cost function, representing the relationship between marginal cost and user costs of inputs. As usual, user cost of labour corresponds to the unit price of inputs, while the user cost of capital is the opportunity cost of funds, the rate of depreciation and the inflation rate (here assumed to be zero), in addition to the price of capital goods.

Under the profit maximization framework, in a world without uncertainty, the quantity of loans will satisfy the equality between the loan interest rate (r_L) and the marginal cost of intermediation (producing) an extra unit of loan.

However, the marginal intermediation costs arising from the inputs, must be corrected to take into account that typically a bank corporation is owned by shareholders who require a minimum (expected) rate of return in order to hold the bank shares (opportunity cost). As a result of the fact that a certain fraction of the loan made by the bank will not be repaid, the bank must also generate a rate of return high enough, not only to cover the opportunity cost of funds, but also to cover the risk of default.[58] The result of such correction is the marginal income from a unit of loan. The equilibrium is:[59]

[11] $(r_L - r^*) = MC(L_n; Z_L, Z_X, Z_K) \cdot (1+\theta)$,

where r^* is the interest rate on the best alternative risk free investment (for instance, on the money market).

[12] $r_L^n = \dfrac{\partial(r_L \cdot r^*)}{MC} \cdot \partial z / \partial r$

which shows that the loan rate exceeds the rate of return required by the financial firm by an amount equal to the return to the loan divided by the cost of producing

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[56] The model can be rigorously developed starting from expressions [1] [2] in the temporal maximization problem, where the financial firm chooses the level of costs in order to obtain the maximum profit. See Appendix 1.

[57] In other terms, economies of scope in the loan and deposit production derivatives are zero.

[58] The return on a unit of loan is given by the difference between the loan rate (r_L) and an alternative risk free investment (for instance, the money market rate). See Appendix 2.

[59] McKenzie (2000) p. 8. Although recognising the central role of equity finance, he does not exclude it as an alternative source and, in the spirit of M&M approach, considers the cost of finance as the usual weighted average between the cost of equity (return on equity) and interest on deposits and of the weights exogenously taken. In this sense, McKenzie consider his own approach to be in the line of Ho and Saunders approach to, when modelling bank behaviour, invokes a simple balance sheet identity relationship that effectively specifies that loans plus reserve requirements must be equal to deposits are the only source of funds so that the opportunity cost of finance is simply the interest rate on deposits.

[60] The specification of the model presented here is modified with respect to Ho and Saunders in order to treat both loans and deposits as assets. In particular, we split up the interest spread into loans over the risk free return and the margin on deposits given by the difference between the alternative return and the (lower) interest paid to depositors. In order to maintain a positive marginal revenue to deposits (a condition arising from the independent specification

5.2 Introduction

Introducing taxes leads to consider a new formulation of the

[13] $MC(L_n; Z_L(1-\tau_L), Z_X(1-\tau_K), Z_K(1-\tau_K))$,

where τ are the traditional METR[61] expressions. [13] can be rearra
obtain a single measure of the tax system on marginal cost (t
effective tax rate on intermediation costs, by aggregating the various expr
METR.

[14] $MC(L_n; Z_L(1-\tau_{mL}), Z_X(1-\tau_{mX}), Z_K(1-\tau_{mK})) = \tau(T)\,MC(L_n; Z_L, Z_X, Z_K)$

The τ_T tax rate thus solves the equation:

[15] $\tau_L = \dfrac{MC_{AT} - MC_{BT}}{MC_{BT}}$

where MC_{AT} and MC_{BT} represent the marginal intermediation costs aft
respectively.

The τ_T rate can be obtained as a weighted average of the M
where factors' shares are the weights.[62] More in detail, under the assumptio
elasticity of substitution between factors (as in a Leontief
intermediation τ_T is a simple arithmetic average of the METRS of the

[16] $\tau_T = (\tau_{mL})s_L + (\tau_{mX})s_X + (1-\tau_{mK})s_K - 1$

Going back to the equilibrium condition [11] we may now in
sides of the equality. For the revenue side, by subtracting t
return and adding up the corporation tax saved on the fract
deductible for risk provision, we get the net revenue from the extra unit
of loan

[17] $(r_L - r^*)(1-\tau_c) - \tau_c\,\pi$

The identity between marginal benefit and marginal cost be

[18] $(r_L - r^*)(1-\tau_c) - \tau_c\,\pi = (\partial L/\partial e)\,MC(L_n; Z_L, Z_X, Z_K)\,(1+\pi)$

that can be reformulated as:

[19] $r_L^g - r^* = \dfrac{\partial(r_L - r^*)}{MC}\,dz = \dfrac{\partial(r_L - r^*)}{\partial(r_L - r^*)(1-\tau_L)(1+\pi)(1-\tau_c)}\,dz$

to obtain the relationship between gross and net of tax rate of return on a marg

Finally, under the traditional METR approach the marginal tax rate o
issuing a loan (an hypothetical tax rate that can transform a
return) can be defined as

[20] $\tau^* = \dfrac{r_L^g - r_L^n}{r_L^n}$

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[61] METR on inputs will be discussed in Appendix 2.

[62] The specific averaging method depends on the assumption about the form

solving for $r_L^g(1-\tau^*) = r_L^g$.[63]

The same methodology can be applied to the tax wedge in the case of the pas
The gross of tax rate of return will be

$$[21]\quad r_D^g = \frac{\partial(r^*-r_D)}{MC_D} = \frac{\partial(r^*-r_D)(1+\alpha_D)}{\partial(r^*-r_D)(1-\tau_c)}$$

where MC_D obviously refer to the marginal cost of additional unit o
deposit and to the METR on the marginal increment of the amount of
deposit.

6. Some preliminary conclusions

From the analysis of banks business we identified several
affecting the mechanisms by which taxation works out its effe
with the optimal financial structure; as for banking firms this is actually the
the production process and has much less to do with the f
accumulation, as for NFFs. A second aspect, related to the f
definition of cost of capital, which is generally referred by banking liter
and is defined as the net price of financial product able to ge
shareholders, high enough to guarantee that the market valu
decrease.

Any attempt to analyse the role of taxation in a banking co
peculiarities. Public finance literature offers a powerful conceptual framew
proved extremely powerful for taxation analysis. However, wealth
models are hardly capable of satisfactorily describing how ban

We reviewed in paragraph 5 a model for cost of capital d
banking firms and in paragraph 6 a particular variant of the
model. With respect to the traditional approaches derived fro
focusing on physical capital, both these models look at the pr
at the investment decision and its financing. Beyond this, for
analysing the effects of taxation on the bank's decision proces

The cost of capital model is able to capture the jointness
(especially the simultaneousness of the loan and deposits
traditional intermediation activity); it also accounts for the a
the optimal financial structure and explicitly takes into accou
on the capital ratios. The expression of the cost of capital
of capital, as in standard cost of capital literature referring
nature of mark-up over the overall return from output. The pres
constraints, applying in different ways to products, differentiates th
capital according to kind of marginal output we refer to (simil

---

[63] Alternatively, the marginal tax rate can be written as $\tau^* = \frac{r_L^g - r_L^n}{r_L^n}$, which is obviously $r_L^n = (1-\tau^*)r_L^g$.

computing NFFs cost of capital, for different marginal sources of investment).

On the other hand, the METR approach, in the version presented impact of the overall taxation on production, so that it better and its intertwining between investment and production. Furt inside the cost of capital the user component, stemming from the and the price embedded in the marginal cost expression, from The latter one, rather than being modelled as the simple cost markets (typically given, in NFFs models, by the interest rat opportunity cost for own capital, or an average of the two), is a mark-up applied to the overall return from the production of financial services. In case of loans an extra component for loans losses

Both models consider the cost of capital as a more gene usually is for NFFs. It is the return on the bank's investments, stemming from the overall inputs (labour, capital and materia losses in case of loans supply, and from taxes.

The integration between these two approaches is complex will continue to be an objective of our research. Taxation can be modell by the METR approach exploiting the equivalence between th average of the METRs on the single inputs. Regulatory restri following the Mendoza, Razin & Tesar approach, diversifying the expressions for the co effective tax rates, not only among types of investment and usually done), but also among different output mixes.

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APPENDIX 1: The model

Starting from a perfect competition framework[64], the profit function of the bank
sketched as:

$$[A1] \quad \Pi = r_L L_n - r^* I + r_D D + OP - C(D, L_n, OP)$$

where L_n, D, OP are loans, deposits and other financial products (net inter-bank loans, k
position) and r_L, r_D, r^* are loan, deposit and interbank rates.
Considering $I = D - L_n$ and $OP = fNO$, where f are fees and NO number of operations
the profit function can be rearranged as:

$$[A2] \quad \Pi = r_L(1-\tau)L_n + r^*(1-\tau_D)D + f\,NO - C(D, L_n, OP),$$

leading to a maximization problem with usual first order co
revenues equal marginal costs:

$$[A3] \quad \frac{\partial \Pi}{\partial L_n} = (r_L(1-\tau) - r^*) - \frac{\partial C}{\partial L_n} = 0$$
$$\frac{\partial \Pi}{\partial D} = (r^*(1-\tau_D) - r_D) - \frac{\partial C}{\partial D} = 0$$
$$\frac{\partial \Pi}{\partial NO} = f - \frac{\partial C}{\partial NO} = 0$$

In a multi-period perspective, the bank's value maximization prob
as:

$$[A4] \quad Max \sum_{t=0}^{\infty} \beta^t [r_L(1-\tau)L_n + (r^*(1-\tau_D)D + OP(1-\tau) - w(1+\tau_L)L - p_C I(1-\tau_C) - T_L(1-\tau_C)]$$

where w is wage, L is the amount of labour, p_C is the price of capital, τ the corporate
product T_L and T_C are respectively, taxes on labour and the corpor
Labour and capital are allocated among different outputs and s

$$[A5] \quad L = L_{Ln} + L_D + L_{OP}$$
$$I = I_{Ln} + I_D + I_{OP}$$

Moreover, taxes on labour and capital are given by

$$[A6] \quad T_L = \tau_L\, w L$$
$$T_C = \tau_C [r_L(1-\tau)L_n + r^*(1-\tau_D)D + f\,NO - w(1+\tau_L)L - p_C I - \delta K]$$

and the bank's problem becomes

$$[A7] \quad Max \sum_{t=0}^{\infty} \beta^t [r_L(1-\tau)L_n(1-\tau_C) + \tau\tau_C\, w\tau_L L + (r^*(1-\tau_D)D(1-\tau_C) + OP(1-\tau)(1-\tau_C) - w(1+\tau_L)L(1-\tau_C) - p_C I + \tau\tau_C\delta K)]$$

---

[64] See, for example, Freixas and Rochet (1997).

under 3 equations of motion:

[A8] $\dot{K} = I - \delta K$

$\dot{L} = I(K, N) - \delta L$

$\dot{D} = d(K, N)$

This problem can be solved by first choosing the amount of input outputs, that minimize costs and then by choosing the leve maximize profits.

The cost minimization problem is:

[A9] $\min \int_0^{\infty} e^{-\rho t} [w(1+\tau_L) L(1-\tau_c) + p_C I - \tau_c \delta K_C] dt$

under the equations of motion [A8].

The resolution of this problem gives the conditional input de and, correspondingly, the cost of producing a given amount o other product), expressed as a function of METR on inputs.

[A10] $C_i = C[., w(1-\tau_L), p_C (A+\delta), \tau_c]$ with $i = L_n, D, OP$

The bank s present value maximization problem is

[A11] $\max \int_0^{\infty} e^{-\rho t} [r_L - r^*) L_n (1-\tau_c) + \tau_c \delta L_n + (r^* - r_D) D(1-\tau_c) + OP(1-\tau_c) - C_L - C_D - C_{OP}] dt$

subject to:

[A12] $\dot{L}_n = I(K, L) - \delta L_n$

$\dot{D} = d(K, L)$

Therefore, the current-value Hamiltonian is

[A13] $H = r_L - r^*) L_n (1-\tau_c) + \tau_c \delta L_n + (r^* - r_D) D(1-\tau_c) + f_N (1-\tau_c) - C_{L_n} - C_D - C_{OP}] + \lambda_1 [I(K, L)_n + d$

that, after some manipulations, gives

[A14] $r_L^g - \delta = \frac{(r_L - r^*)}{MC_{L_n}} - \delta - \dot{z} - \delta = \frac{(r_L - r^*)(1-\tau_L)(\partial r / \partial z)}{(r_L - r^*)(1-\tau_c) + \tau_c \delta g \partial z} - \delta - \dot{z}$

and

[A15] $r_D^g - \delta = \frac{(r^* - r_D)}{MC_D} - \delta = \frac{(r^* - r_D)(1-\tau_D)\partial r}{(r^* - r_D)(1-\tau_c)} - \delta$

where MC_{L_n} and MC_D refer to the marginal cost of intermediating a loan and deposit, and r_L^g and r_D^g the corresponding METR.

Appendix 2: METRs on inputs

METR on labour

The marginal effective tax rate on labour incorporates soc
necessary, other taxes on value added, sales, profits, income, capital and
are differentiated with category of worker and, in order to
measure, could be necessary to refer to a typical worker. In
rate of return of labour is

[A16] $r^n = w$

Then, adding social contributions, we have

[A17] $r^g = w(1+t_L)$

where r^g is the after tax rate of return and t_L is the social contribution ra
METR is

[A18] $$t_{mL} = \frac{r^g - r^n}{r^n} = \frac{w(1+t_L) - w}{w} = t_L$$

METR on capital

Tangible capital

In the traditional analysis of investment, the fundamental co
effects of tax is the user cost of capital, a concept introduc
developed by several authors. This concept is based on the e
and owning a piece of durable capital. In its simplest form, th
the financial cost of capital or the opportunity cost of funds, a
average (a) is (the debt asset ratio) of the nominal interest rate (i) and
equity (y) (less the expected rate of inflation (p).

[A19] $r^n_k = a\,i + (1-a)\,y - p$

The definition needs to be broadened to incorporate economic d
prices, and taxes. In the standard user cost formula, capita
geometrically. As with any microeconomic price variable, the
defined as a relative price. The numerator is the (net) price of the new
denominator depends on an additional assumption about the b
new unit of capital. For a firm maximizing profit, the relevant benefit is t
output, and the price of output appears in the denominator.
A variety of taxes can be reflected in the user cost formula: the
as a business expense gradually over the life of the asset. Th
of current and future tax depreciation deductions (the rate of

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[65] The expression results from the usual maximization condition. If the n
productivity of labour is equivalent to $w(1+t_L)$, where t_L is deductible for corpora
purposes, we obtain $MPL(1-t_c) = w(1+t_L)(1-t_c)$ and $MPL = r^g = w(1+t_L)$

taxation (τ), (and the combined expression enters the user cost for the purchase price. Income taxes also enter the model by low the denominator and per unit capital cost for capital if nominal interest tax deductible. Lastly, investment tax credits (k) on the purchase of new capital be considered; these credits are reductions in tax liabilities o the price of purchased asset.
More in details, the user cost can be written as

[A20] $$ucc = r(\pi + \delta)q\,(1 - k - \tau z)\,/\,(1 - \tau)$$

with $r^f = \alpha r\,(1 - \tau) + (1 - \alpha)\pi$

where α is, again, the share of debt in total assets. Normalizing and considering δ the depreciation marginal productivity (that maximization assumption is equal to the user cost), we have

[A21] $$r^g_k = r(^f + \pi - \delta)\,(1 - k - \tau z)\,/\,(1 - \tau)$$

that is the gross of tax rate of return of marginal investment.
As previously discussed, the share of debt in total capital is zero in the financial firm where risk capital is adequate for prudential purposes. At the same time, financial services are exempt from VAT and, cannot deduct from their VAT liability the amount of tax they paid on purchas goods as NFFs do.

[A22] $$r^g_k = [\tau_{at} + (1 - \tau_{at})\,\alpha_R]\,\pi + (r - \delta)\,(1 - k - \tau z)\,/\,(1 - \tau)$$

where τ_{at} is the VAT rate and α_R is the debt-to-capital coefficient.
In case of buildings, however, there is no input tax deductibility. VAT to b

Intangible capital

In order to calculate METRs on research and development ac intangible assets or human capital accumulation, labour inputs split up. Differences from previous analyses persist with regard to specific and amortization period embedded in tax legislation.
As usual, the METR can be computed as:

[A23] $$t_{mL} = \frac{r^g - r^n}{r^n}$$

[66] As the output of a financial firm consists of both exempt and only the taxable operations qualifies for VAT deductibility, the problem of appor paid on purchased inputs between taxable and non-taxable output arises. Rate of tax rule is a method for dealing with this problem. Deductible input taxes can be ob taxable output and total output to the total input tax paid.